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EXAMINER	
BERMAN, JASON	

ART UNIT	PAPER NUMBER
1795	

NOTIFICATION DATE	DELIVERY MODE
03/18/2009	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/500,005	DONOHUE ET AL.	
	Examiner	Art Unit	
	Jason M. Berman	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _12/5/2008_.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _1-24_ is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) _1-24_ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Status of the Claims

Claims 1-24 are pending in the current application.

Response to Amendment

Applicant's amendment of 12/05/2008 does not render the application allowable.

Status of the Rejections

All rejections from the previous office action are withdrawn in view of Applicant's amendment. New grounds of rejection under 35 U.S.C. 103(a) are necessitated by the amendments.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

   1. Determining the scope and contents of the prior art.
   2. Ascertaining the differences between the prior art and the claims at issue.
   3. Resolving the level of ordinary skill in the pertinent art.
   4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

3. Claims 1-6, 8-9, 12-15 and 23-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Flamm (US 5,711,849) in view of Gerrish (US 5,770,922).

As to claim 1, Flamm discloses a method of material processing, the method comprising:

- Characterizing a process, said characterizing comprising identifying a signature of said process (abstract: method of obtaining a desired etch profile for a substrate);
- Wherein said signature comprises at least one spatial component (col 13 lines 45-52: etch rate profile determined and plotted (fig. 9) as rate vs radial distance from center of substrate);
- Optimizing said process, said optimizing comprising identifying a reference signature, comparing said signature of said process with said reference signature (Figure 4: varying temperature and pressure to obtain desired etch rate verse effective area);
- Wherein said comparing comprises determining a difference signature representing a difference between the measured and reference signatures (Figure 5: comparing etch rate (315) to desired uniformity (301)); and
- Determining a process fault by comparing said difference signature with a threshold, wherein said process fault occurs when said threshold is exceeded (Fig. 5: step 315 – determine if the etch rate is too low and changing the process if so; col 9 lines 1-10: calculation of desired uniformity using minimum and maximum desired etch rates).

Flamm, while discloses the use of Fourier analysis of the collected data (col 14 lines 51-54), is silent as to the actual conversion of the data into spectral space.

Gerrish discloses a method of analyzing data collected from a plasma processing apparatus (abstract). Gerrish discloses the conversion of collected data, by fast Fourier transform operation, into spectral data for analysis and calculation useful in control of the plasma process (col 3 lines 45-66).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to convert the data collected into spectral space, as disclosed by Gerrish, in the feedback control method of Flamm, because spectral data analysis can be used for accurate control of plasma operations.

As to claim 2, Flamm discloses said performing the process on a substrate (abstract: method involves etching of a substrate).

As to claim 3, Flamm discloses said substrate is a wafer or LCD (col 12 line 61: example using a circular substrate (wafer); col 13 line 67: calculations using LCD as substrate).

As to claim 4, Flamm discloses the process performance parameter is etching rate (abstract: determining etch rate for the process).

As to claim 5, Gerrish discloses the transforming comprises applying a discrete Fourier transform to the measured data (col 3 line 57: fast Fourier transform operation performed).

As to claim 6, Flamm discloses characterizing the relation between the signature and controllable process parameters comprises multivariate analysis (col 8 lines 57-60:

etch parameters include reactor dimension, pressure, temperature and other parameters).

As to claim 8, Flamm does not explicitly state that the multivariate analysis involves design of experiment. However, design of experiment is defined as an information gathering exercise with variation of controlled parameters. Flamm, as illustrated in figures 4 and 5, is attempting to obtain a desired etch rate profile by varying effective substrate area, temperature, and pressure. Therefore, Flamm is inherently engaged in a design of experiment analysis of multiple variables.

As to claim 9, Flamm discloses the controllable process parameter as pressure, temperature, gas flow rate, and RF power (col 1 lines 55-57: selection of temperature, pressure, gas flow rate, and RF power to obtain desired etch profile).

As to claim 12, Flamm discloses the measuring comprises obtaining a multi-dimensional scan of data (claim 4: spatial coordinate includes an x and y-direction).

As to claim 13, Flamm discloses the multi-dimensional scan of date is a two-dimensional scan of data (claim 4: spatial coordinate includes an x and y-direction).

As to claim 14, Flamm discloses a system for material processing comprising:

- A process chamber (abstract: plasma processing apparatus);
- Device for measuring and adjusting at least one controllable process parameter (Fig. 2: showing apparatus with flow, temperature and pressure controller);

- Device for measuring at least one process performance parameter, and controller (col 4 lines 25-27; figure 2: temperature, pressure and flow controllers);
- A controller capable of characterizing a process, said characterizing comprising identifying a signature of said process (col 13 lines 45-52: etch rate profile determined and plotted (fig. 9) as rate vs radial distance from center of substrate);
- Wherein said signature comprises at least one spatial component
- Optimizing said signature of said process with said reference signature for the process (Figure 4: varying temperature and pressure to obtain desired etch rate verse effective area);
- Wherein said comparing comprises determining a difference signature (Figure 5: comparing etch rate (315) to desired uniformity (301)); and
- Determining a process fault by comparing said difference signature with a threshold, wherein said process fault occurs when said threshold is exceeded (Fig. 5: step 315 – determine if the etch rate is too low and changing the process if so; col 9 lines 1-10: calculation of desired uniformity using minimum and maximum desired etch rates).

Flamm, while discloses the use of Fourier analysis of the collected data (col 14 lines 51-54), is silent as to the actual conversion of the data into spectral space.

Gerrish discloses a method of analyzing data collected from a plasma processing apparatus (abstract). Gerrish discloses the conversion of collected data, by fast Fourier

transform operation, into spectral data for analysis and calculation useful in control of the plasma process (col 3 lines 45-66).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to convert the data collected into spectral space, as disclosed by Gerrish, in the feedback control method of Flamm, because spectral data analysis can be used for accurate control of plasma operations.

As to claim 15, Flamm discloses the process chamber is an etch chamber (abstract).

As to claims 23 and 24, both Flamm and Gerrish are directed towards a method and apparatus for measuring data within a plasma chamber, analyzing the data, and providing feedback to control the given process. Flamm discloses the control of RF power and pressure and temperature (as discussed above, figure 5). Each of these variables measured and controlled is inherently either global or local [temperature is a local variable, pressure is a global variable, etc].

1. Claims 1-5, 10-15 and 23-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Farber (US 6,232,134, as cited in IDS) in view of Gerrish (US 5,770,922).

As to claim 1, Farber discloses a method of material processing, the method comprising:

- Characterizing a process, said characterizing comprising identifying a signature of said process (abstract: wafer processing involving measuring of surface charge distribution);

- Wherein said signature comprises at least one spatial component (Figs 2-4: charge distribution measured as circular gradient);
- Optimizing said process, said optimizing comprising identifying a reference signature, comparing said signature of said process with said reference signature (Fig. 1: steps 108 and 110: comparing measure surface charge distribution with known distribution and evaluate process based on results);
- Wherein said comparing comprises determining a difference signature (col 6 lines 29-34: determination of difference between measured and desired distribution); and
- Determining a process fault by comparing said difference signature with a threshold, wherein said process fault occurs when said threshold is exceeded (col 6 lines 33-37: comparison either within tolerable range or outside tolerable range).

Farber, while disclosing the collection and analysis of current density data, is silent as to the actual conversion of the data into spectral space.

Gerrish discloses a method of analyzing voltage or current data collected from a plasma processing apparatus (abstract). Gerrish discloses the conversion of collected data, by fast Fourier transform operation, into spectral data for analysis and calculation useful in control of the plasma process (col 3 lines 45-66).

As to claim 2, Farber discloses said performing a process comprises processing a substrate (abstract: method involves processing of a wafer).

As to claim 3, Farber discloses said substrate is a wafer (abstract: processing of a wafer).

As to claim 4, Farber discloses the process performance parameter is the film property (abstract: determining surface charge distribution pattern on wafer).

As to claim 5, Gerrish discloses the transforming comprises applying a discrete Fourier transform to the measured data (col 3 line 57: fast Fourier transform operation performed).

As to claim 10, Farber discloses the improvement comprises an improvement of spatial uniformity of the scan of data (col 10 lines 35-40; fig. 6: showing process of comparing measured charge distribution (650) with desired distribution (630) and output 660 to alter process if a problem is present).

As to claim 11, Farber discloses a minimization of at least on spatial component (col 10 lines 35-40; fig. 6: showing process of comparing measured charge distribution (650) with desired distribution (630) and output 660 to alter process if a problem is present. The process minimizes the difference between the measured and desired distribution upon visual scanning).

As to claim 12, Farber discloses the scan of data is a multidimensional scan of data (Figs 2-4: showing surface charge distribution as a 2-d graphical plot).

As to claim 13, Farber discloses the multidimensional scan of data is a two-dimensional scan of data (Figs 2-4: showing surface charge distribution as a 2-d graphical plot).

As to claim 14, Farber discloses a system for material processing comprising:

- A process chamber (col 3 lines 48: processing in a chamber);
- Device for measuring and adjusting at least one controllable process parameter (col 10 lines 35-37: adjusting process operations being performed);
- Device for measuring at least one process performance parameter, and controller (col 10 lines 21-24 and 35-37: measuring charge distribution and adjusting process operations being performed);
- Said controller capable of characterizing a process, said characterizing comprising identifying a signature of said process (abstract: wafer processing involving measuring of surface charge distribution; col 7 line 57 to col 8 line 5: process characterized with etch rate, selectivity, etc.);
- Wherein said signature comprises at least one spatial component (Figs 2-4: charge distribution measured as circular gradient);
- Optimizing said signature of said process with said reference signature for the process (Fig. 1: steps 108 and 110: comparing measure surface charge distribution with known distribution and evaluate process based on results);
- Wherein said comparing comprises determining a difference signature (col 6 lines 29-34: determination of difference between measured and desired distribution); and
- Determining a process fault by comparing said difference signature with a threshold, wherein said process fault occurs when said threshold is

exceeded (col 6 lines 33-37: comparison either within tolerable range or outside tolerable range).

Farber, while disclosing the collection and analysis of current density data, is silent as to the actual conversion of the data into spectral space.

Gerrish discloses a method of analyzing voltage or current data collected from a plasma processing apparatus (abstract). Gerrish discloses the conversion of collected data, by fast Fourier transform operation, into spectral data for analysis and calculation useful in control of the plasma process (col 3 lines 45-66).

As to claim 15, Farber discloses the process chamber is an etch chamber (col 3 lines 38-40).

As to claims 23 and 24, both Farber and Gerrish are directed towards a method and apparatus for measuring data within a plasma chamber, analyzing the data, and providing feedback to control the given process. Farber discloses the determination of an etch rate by measuring a charge distribution and feedback control of power, gas pressure and wafer position in the chamber. Each of these variables measured and controlled is inherently either global or local [charge distribution and temperature are local variables; pressure is a global variable, etc].

2. Claim 7 and 10-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Flamm in view of Gerrish, as applied to claims 1 and 6 above, and further in view of Angell (US 5,658,423).

As to claim 7, Flamm and Gerrish are silent as to the use of principal component analysis.

Angell discloses a method of monitoring an etching process, comparing measured data to a reference model, and taking corrective actions to fix any failures (abstract). Angell also discloses the use of principal component analysis to analyze multi-dimensional process data (col 4 lines 21-25). This analysis technique is disclosed as allowing for catastrophic faults to be reliably detected with simple calculations (col 4 lines 42-46).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to use principal component analysis, as disclosed by Angell, in the method of material processing of Flamm, because it allows for simple calculations to reliably detect process faults.

As to claim 10, Flamm and Gerrish are silent as to an improvement comprising the spatial uniformity of a scan of data.

Angell discloses the improvement to the process involves an increase in the spatial uniformity of a scan of data (Fig. 5: showing a sample spectral graph of measured and desired spectra [overlaid]; col 8 lines 7-15: observation of fault in figure 5 will allow corrective actions to be taken). The use of overlaid spectrum for visually identifying non-uniform data is disclosed as allowing for a monitoring system allowing interpretation by operators who are not experts (col 4 lines 32-35).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to improve spatial uniformity of scan data, as disclosed by Angell, in the method of material processing of Flamm, because it allows for non-expert operators to interpret potential faults.

As to claim 11, Angell discloses the improvement comprises a minimization of the spatial components (Fig. 5: col 8 lines 7-15: adjustments to process made in order to obtain identical overlay of measured and desired spectra).

3. Claims 16-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Flamm in view of Gerrish, as applied to claim 14 above, and further in view of Scott (US 5,601,869).

As to claims 16-22, Flamm and Gerrish are silent as to the use of a CVD or PVD chamber, a photoresist coating chamber, a spin-on-dielectric system, a photoresist patterning chamber, a UV lithography system, a rapid thermal processing chamber, or a batch diffusion furnace.

As to claims 16-22, Scott discloses a process of forming thin-film electrical components for use in integrated circuits (col 1 lines 23-25). Scott also discloses the use of a PVD chamber (col 8 lines 21: sputtering adhesion layer), a photoresist coating chamber (col 10 lines 63-66: sputtering of resist layers), a spin-on-dielectric system (col 10 lines 41-44: dielectric layer formed by spin on process), a photoresist patterning chamber (col 11 line 3-4: etching resist), a UV lithography system (col 11 line 11: UV exposure of photo mask), a rapid thermal processing chamber (col 10 line 20: rapid thermal processing anneal), and a batch diffusion furnace (col 8 line 57: use of diffusion furnace).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to use a system for optimizing a process, as disclosed by Flamm, in the sputtering, spin-on coating, photoresist coating and patterning, lithography,

diffusion furnace, and rapid thermal processing chambers of Scott because of the improvement from monitoring and adjusting the process to avoid faults and obtain the desired results.

4. Claims 16-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Farber in view of Gerrish, as applied to claim 14 above, and further in view of Scott.

As to claims 16-22, and Gerrish are silent as to the use of a CVD or PVD chamber, a photoresist coating chamber, a spin-on-dielectric system, a photoresist patterning chamber, a UV lithography system, a rapid thermal processing chamber, or a batch diffusion furnace.

As to claims 16-22, Scott discloses a process of forming thin-film electrical components for use in integrated circuits (col 1 lines 23-25). Scott also discloses the use of a PVD chamber (col 8 lines 21: sputtering adhesion layer), a photoresist coating chamber (col 10 lines 63-66: sputtering of resist layers), a spin-on-dielectric system (col 10 lines 41-44: dielectric layer formed by spin on process), a photoresist patterning chamber (col 11 line 3-4: etching resist), a UV lithography system (col 11 line 11: UV exposure of photo mask), a rapid thermal processing chamber (col 10 line 20: rapid thermal processing anneal), and a batch diffusion furnace (col 8 line 57: use of diffusion furnace).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to use a system for optimizing a process, as disclosed by Farber, in the sputtering, spin-on coating, photoresist coating and patterning, lithography, diffusion furnace, and rapid thermal processing chambers of Scott because of the

improvement from monitoring and adjusting the process to avoid faults and obtain the desired results.

Response to Arguments

4. Applicant's arguments filed 12/9/2008 have been fully considered but they are not persuasive.

5. Applicant's arguments with respect to claims 1 and 14 have been considered but are moot in view of the new ground(s) of rejection.

The new grounds of rejection address the newly added limitation of transforming the measurement data into spectral space to identify a signature of the process.

Conclusion

6. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jason M. Berman whose telephone number is (571)270-5265. The examiner can normally be reached on M-R 8am-5pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on (571)272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Nam X Nguyen/
Supervisory Patent Examiner, Art Unit 1753

/J. M. B./
Examiner, Art Unit 1795